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A NEW NARCOTIC GENUS FROM THE AMAZON SLOPE OF THE COLOMBIAN ANDES

BY

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RECENT ethnobotanical investigations in Colombia have greatly advanced our understanding of the narcotic and stimulant plants which are used in divination, witchcraft and medicine by the Indians of the region. The discovery, in the high and geographically isolated Indian village of Sibundoy, of a dangerously active narcotic tree, representing a new genus belonging apparently to the *Solanaceae*, may have significant consequences in several different fields of study.

In early 1942, whilst I was engaged in ethnobotanical studies in the Putumayo of Colombia, my attention was drawn to a most extraordinary tree which the Kamsá and Inga Indians of the Valley of Sibundoy cultivate for use as a narcotic. Flowering material was collected, an examination of which seemed to indicate that a new genus close to the *Brugmansia* group of *Datura* had been found. In the following years, I made several trips to Sibundoy and was able to gather additional material from the original and several adjacent trees; and colleagues, who have travelled in the area, have been kind enough to prepare specimens from still other trees both in the village of Sibundoy and the neighboring town of Santiago. In

1953, we were able finally to introduce the tree into cultivation in easily accessible gardens. Now, with plentiful material and after more than a decade of cautious consideration, I still hold that we have at hand an undescribed genus, the diagnosis of which is presented herewith.

Methysticodendron *R. E. Schultes gen. nov. Sollanacearum.*

Arbor. Folia ligulata. Flores solitarii, maximi, penduli. Calyx longe tubulosus, herbaceus, spathaceus. Corolla profundissime quinquedivisa, lobis spathulatis, acuminatis. Stamina tubi apicem versus affixa, filamentis robustioribus, apicem versus attenuatis et valde contortis; antherae lineares, loculis parallelis introrsum longitudinaliter dehiscentibus. Ovula in quoque loculo numerosa, in placentis axillaria. Styli tres, liberi (sed aspectu singulares, mucilagine (?) cohaerentes, valde tortiles), crassiore filiformi-ligulati sed in sectione concavo-complanati, stigmate indiviso, clavellato-tumescenti; ex ovarii parte centrali duo vel tres appendices, una filiformis, stylo subsimilis sed multo brevior atque una vel duae ad subulas brevissimas vel bullas reductae. Fructus non est praesto.

Genus apparenter *Datura* sectione *Brugmansia* satis affine est.

Generis nomen Graece "arbor somnifica," inter indigenas usum perstringens, significat.

Generis species typica: *Methysticodendron Amesianum.*

Methysticodendron Amesianum *R. E. Schultes spec. nov.*

Arbor usque ad viginti quinque pedes alta, ramulis brevibus, dense foliatis. Folia membranacea, atroviridia, anguste lineari-ligulata, apice acuminata, basi sensim attenuata (saepissime sine petiolo distincto), margine vulgo

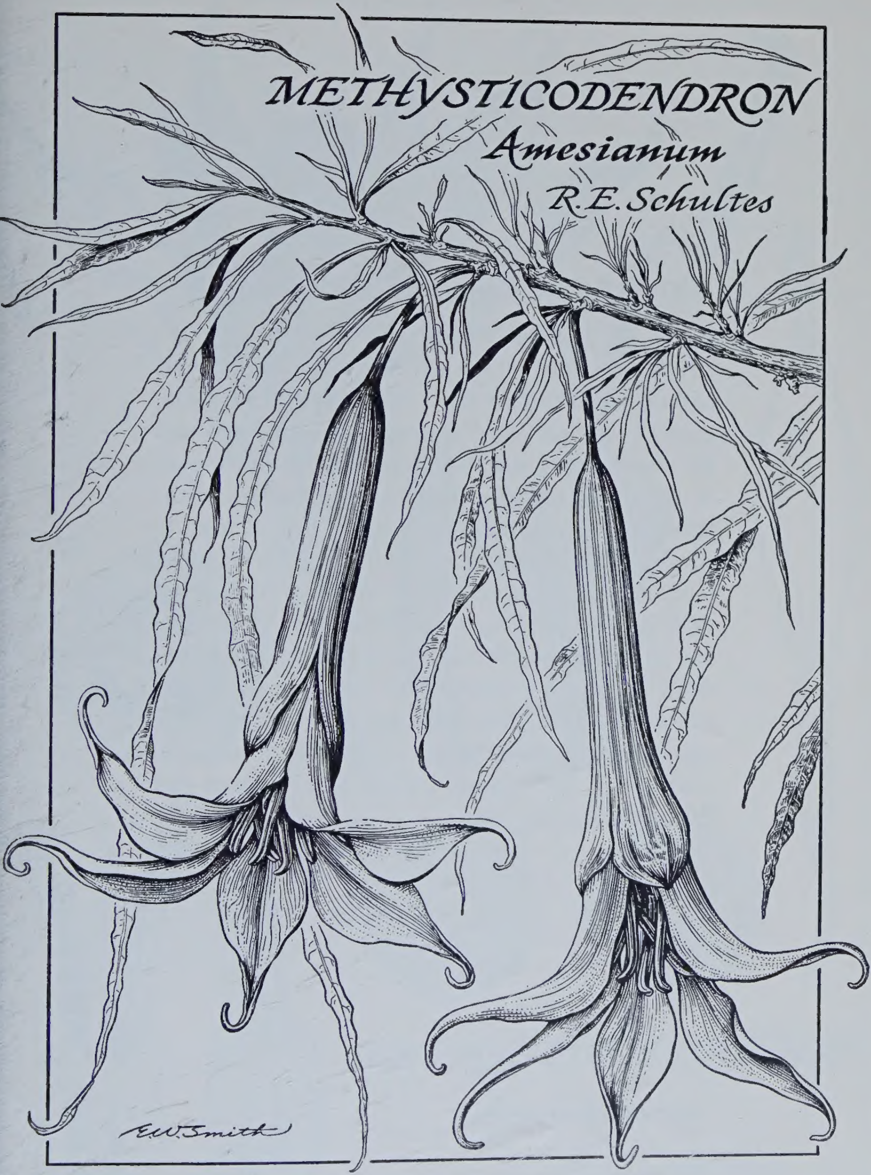
subundulata vel undulata, statu adulto 20–26 cm. longa, 1.3–2.0 cm. lata, nervo centrali robusto, subtus valde elevato, nervis secundariis subparallelis, subconspicuis, marginem versus arcuato-anastomasantibus, utrinque minute et irregulariter (venas versus densiore) pilosa. Flores usque ad 28 (plerumque plusminusve 23) cm. longi, apice in anthesi 10–13 cm. in diametro, solis occasu atque noctu fortissime et dulcissime fragrantes. Calyx spathaceus, viridis, papyraceus vel membranaceus, duo- ad quinquefissus, dentibus acutis, per dimidium tubiformis, 3/5 corollae longitudine (usque ad 13 cm. longus), utrinque minutissime et irregulariter pilosiusculus. Corolla 3/5–4/5 pro parte divisa, lobis saepissime quinque (sed abnormaliter quattuor vel sex), membranaceis, albis, patentibus, spathulatis vel subspathulate rhombiformibus, apice longe acuminatis, cincinnalibus, margine integris, dimidio superiore valde inflexis, 14–16 cm. longis, tubi apicem versus plerumque 6 mm. sed in parte latiore 2.5–3.3 cm. latis, basim versus utrinque remotissime et irregulariter pilosiusculis, tribus cum venis conspicuis, valde parallelis; tubus intus densiore albido-pilosus. Stamina saepissime quinque, corollae lobis breviora, filamentis teretibus, plusminusve 5 cm. longis, basi 2 mm. in diametro, apice valde contortis atque leviter tortilibus, apice excepto pilosiusculis, antheris flavis, 2.7–3 cm. longis, 3–4 mm. in diametro. Ovarium subcylindricum, conspicue trisulcatum, glabrum, usque ad 1.5 cm. longum, 0.5 cm. in diametro, in stylos sensim productum. Styli glabri, usque ad plusminusve 9 cm. longi, 2.5 mm. in diametro, apice paulo clavellati et valde complanati, stigmatis textu in apice ipso et in marginibus usque ad 1–1.5 cm. decurrenti, nigro (siccitate) et papilloso. Appendix (stylus incohatus ?) ex ovarii parte centrali stylis similis, usque ad 5.5 cm. longa, ab una vel duabus appendicibus subclavellatis carnosis, 2–5 mm. longis comitata.

EXPLANATION OF THE ILLUSTRATION

PLATE I. METHYSTICODENDRON AMESIANUM *R. E. Schultes*. Habit drawing of a flowering branch, about one half natural size.

Drawn by ELMER W. SMITH

PLATE I

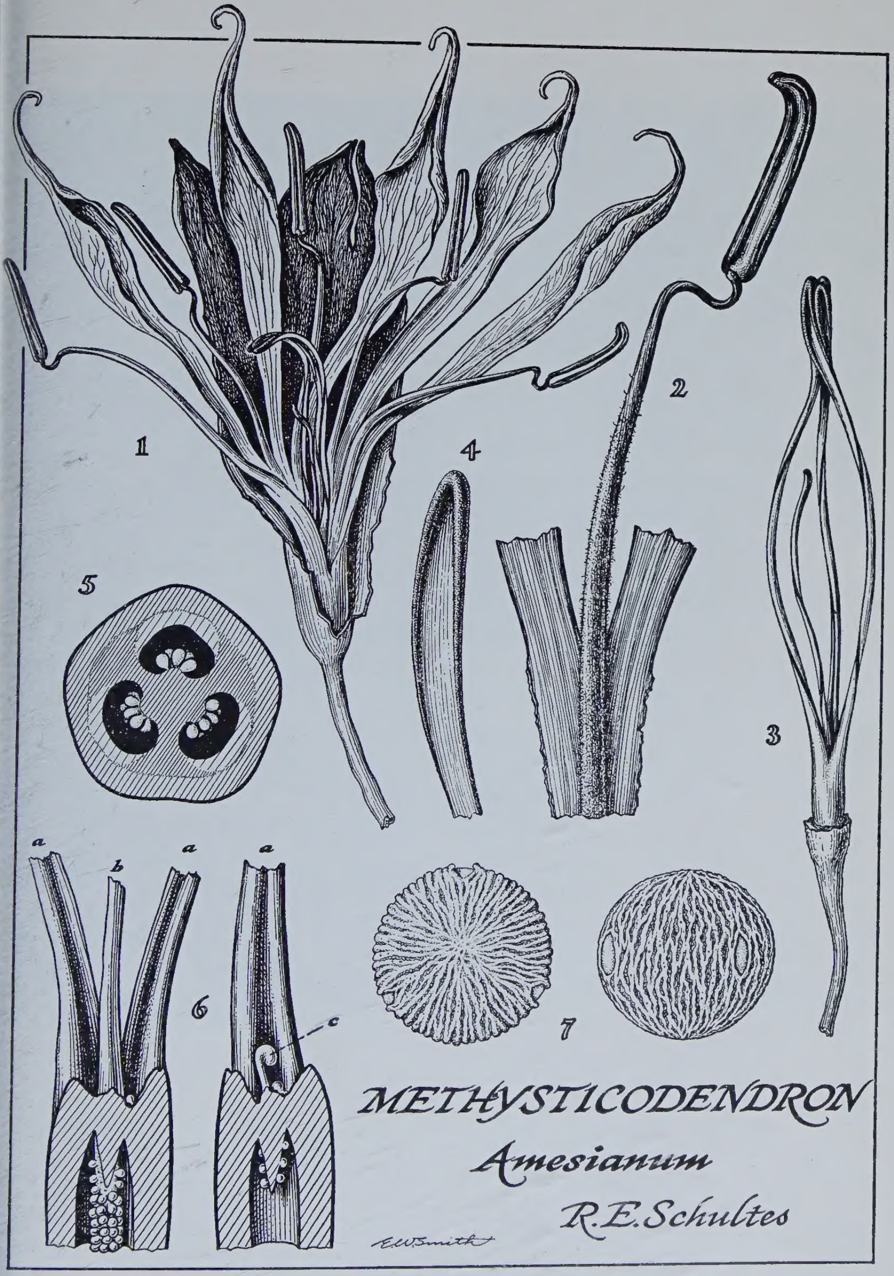


EXPLANATION OF THE ILLUSTRATION

Plate II. Methysticodendron Amesianum *R. E. Schultes.* 1, partly dissected flower, about one half natural size, showing the relative sizes of stamens, styles and other floral segments. 2, a stamen and its attachment, slightly more than natural size. 3, the styles and the style-like appendage, about three quarters natural size. 4, the tip of a style showing the stigmatic surface, about three times natural size. 5, cross section of the ovary, about six times natural size. 6, sagittal section of the apical part of the ovary showing (a) styles, (b) the large appendage homologous with the styles and (c) one of the minute appendages arising from the central tissue of the ovary, about three times natural size. 7, pollen grains, about four hundred and fifty times natural size.

Drawn by Elmer W. Smith

PLATE II


1
2
3
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5
a
b
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a
c
6
7
METHYSTICODENDRON
Amesianum
R.E.Schultes
E.W.Smith

EXPLANATION OF THE ILLUSTRATION

PLATE III. Habit photograph of the plant from which the type of *Methysticodendron Amesianum* was taken. Sibundoy, Colombia.

Photograph by RICHARD EVANS SCHULTES

PLATE III

EXPLANATION OF THE ILLUSTRATION

Plate IV. Kamsá Indian boy holding a flower of *Methysticodendron Amesianum.* Sibundoy, Colombia.

Photograph by Richard Evans Schultes

Plate IV

Specei nomen professorem rerum herbarum demortuum Oakes Ames Universitatis Harvardianae, quis studia mea plantarum somnificarum inter indigenas americanos excitavit, honorat.

Methysticodendron is here described as a genus of the *Solanaceae* with some hesitation, for the concept shows several characters which are not easily accommodated in that family.

In habit, *Methysticodendron Amesianum* is a small tree quite suggestive of some of the larger tree-species of *Datura*, i.e., *D. arborea* L., *D. suaveolens* HBK. and *D. Rosei* Safford. Like these members of the *Brugmansia* section of *Datura*, the new concept is characterized by large, pendulous flowers. The intoxication which a decoction of the leaves of *Methysticodendron Amesianum* induces bespeaks the presence of similar alkaloids: hyoscyamine and scopolamine. There are also strong similarities in the branching, as well as in the structure of the calyx and stamens.

The pollen grains of the type plant of *Methysticodendron* have been studied by Dr. Thomas van der Hamen, palynologist to the Servicio Geológico Nacional of Colombia and by Professor Elso S. Barghoorn of the Botanical Museum of Harvard University. Dr. Barghoorn's description of the grains follows:

> Pollen grains spherical, chiefly inaperturate, occasionally tricolporate or triporate with very weakly developed short furrows. Size ranging from 45μ to 63μ, averaging about 53μ (after acetylation). Sculpturing of the exine striate, and of the "finger print" pattern of striation. Striae converging at the poles and commonly anastomising between the poles. Polar areas reticulate-foveolate. A feeble punctate or reticulate texture may be detected between the striae or along their sides. Equatorial costae conspicuous.
>
> In basic morphology the grains are a modified bipolar, tricolpate type, in which both pores and furrows have been greatly reduced.

The pollen grains of *Methysticodendron* are of the same type and are, indeed, very similar to the grains of other species of *Datura*, section *Brugmansia*.

Notwithstanding these similarities, *Methysticodendron* can be distinguished at once from the tree-species of *Datura* by its very deeply lobose corolla which is divided for three-fifths to four-fifths of its length. The tubular portion of the corolla is wholly enclosed within the tubular, spathaceous calyx, so that it bears a superficial resemblance to a polypetalous flower, the gamopetalous condition not being evident as the blossoms hang on the tree. The narrowly ligulate leaves are also strikingly unlike those of the tree-species of *Datura*.

The major and perhaps fundamental departure from the solanaceous condition, however, lies in the morphology of the ovary and styles. *Methysticodendron* has three conduplicate carpels with three free styles (with undivided stigmatic areas) which retain the conduplicate condition. The concave structure of the styles leaves the ovule cavity somewhat open at the apex, exposing the apical ovules, until, about one third of the way down, the carpel walls fuse to form a trilocular syncarp. All members of the *Solanaceae* have a simple style with a two-lobed stigma. All members of the tribe *Datureae* have a four-celled ovary. Indeed, the only tribe of the family possessing a three- to five-celled ovary is the *Nicandreae*, but even *Nicandra* has a simple style.

The structures most difficult of interpretation are the several appendages arising from the central tissue of the ovary. One of these is an elongated appendage usually entirely homologous with the styles (even to the presence of what appears to be stigmatic tissue), but much shorter. Accompanying this appendage are usually one or two anomalous knob-shaped, clavate or even subulate projections. These do not appear to arise consistently from any definite part of the ovary. They resemble adventitious style-like outgrowths.

Several fruits of *Methysticodendron Amesianum* were collected in 1947. These were preserved in alcohol and sent to Bogotá, but, unfortunately, they were lost in shipment. Consequently, a detailed description of them cannot be given here. We may record, however, that they were unarmed, smooth, indehiscent and fusiform, about six inches in length and in shape very like the fruit of *Datura suaveolens.*

The evidence for retaining *Methysticodendron* in the *Solanaceae* seems to me to be overwhelming. Nevertheless, the several fundamental characters in which this concept diverges from the conditions now embraced by the family must be borne in mind. It would seem entirely probable that a new tribe should be set up within the *Solanaceae* to accommodate *Methysticodendron.*

Would we not be warranted in suspecting that we have at hand perhaps a primitive representative of the *Solanaceae*, possibly a prototype of what has today developed into the tree-species of *Datura?* The apparent primitiveness in the union of floral parts might conceivably be interpreted in this light. In any consideration that *Methysticodendron* may represent a prototype of the modern representatives of the brugmansioid *Datura*-species, it would be advisable to take into account the interesting fact that the Valley of Sibundoy, a locality which we know to be a repository of many curious endemics, is a high Andean region, and the center of origin of some tree-species of *Datura* is thought to be the northern Andean area.

Because of the extreme rarity of this plant, even in the Valley of Sibundoy, and because of its extraordinary beauty, several attempts were made to introduce *Methysticodendron Amesianum* into cultivation. In 1953, efforts to establish it by planting short sticks cut from the upper branches met with success. The species is now in cultivation in the Capuchin Mission Station at Sibundoy; in the gardens of the Ciudad Universitaria in Bogotá, Colombia; in the Universidad del Cauca, Popayán, Colombia; at the Royal Botanic Gardens, Kew; in the greenhouses of the Department of Biology, Harvard University; and at the Division of Plant Exploration and Introduction, Bureau of Plant Industry, Beltsville, Maryland.

Methysticodendron Amesianum, known only from the Valley of Sibundoy, is there employed by the Inga and Kamsá Indians in their witchcraft. Its use in each tribe is restricted to several witch-doctors, and these practitioners grow the plant with special care in the neighborhood of their huts. The wild habitat of the species is said to be the forested slopes of the mountains to the south of the Valley of Sibundoy, especially the slopes of the botanically almost completely unknown Cerro Patascoy. When in cultivation, the plant is apparently the hereditary property of certain families, forasmuch as the sorcerers pass it on to the eldest son together with the secrets attending its use.

Little could be learned about the use of the narcotic, partly because of the proximity of influential Christian missionaries. It would appear from what information I have been able to glean that *Methysticodendron Amesianum*, which the Indians classify together with other intoxicating solanaceous plants similarly used, is by far the strongest of all the narcotics of the region, surpassing in danger and potency even *Datura arborea*. A description of the intoxication leaves no doubt that the active principles are solanaceous alkaloids of the tropane series. This intoxication, resorted to by the witch-doctors only for very important or difficult cases of divination, prophecy or therapy, usually lasts for two full days and sometimes may persist for four—with a long period of complete lack of consciousness. Missionaries who have been at work in the Valley of Sibundoy for more than a quarter of a century suspect that the death of one aged witch-doctor may have been due to an overdraught of this narcotic.

Smaller doses of the drug are administered to boys who are studying witchcraft. Certain of the medicine-men's secrets apparently are imparted only when the novitiate is "under the protection" of this narcotic.

According to the sparse information available, only the leaves of *Methysticodendron Amesianum* can be employed in the preparation of the narcotic infusion. The leaves, which must be gathered not more than one hour before the narcotic drink is to be taken, are stripped from the plant, crushed and allowed to remain in cold water for perhaps one half hour. Just before the draught is to be taken, the leaves and the infusion are slightly heated and agitated. Then the liquid is strained. It is, apparently, never allowed to boil.

Witch-doctors never take the whole draught at one time, it is said; but they may drink as much as a large cup-full over a period of two or three hours. If, by then, the desired frenzy and initial narcosis have not been induced, an assistant prepares additional drink from fresh leaves.

According to the Indian tradition, this narcotic must be taken only during the wane of the moon.

In addition to its use in divination and prophecy, *Methysticodendron Amesianum* is employed by its "owners" in the treatment of certain diseases. The leaves and flowers are heated in water and applied in the form of a plaster for the reduction of tumors and swellings, especially of the joints. For persistent chills and fevers (advanced tuberculosis (?)), which are not uncommon at this high, damp altitude, the witch-doctor will sometimes first bathe the whole body of a patient with a warm decoction of the leaves and flowers, then smear lamb-fat on the chest, back and abdomen.

The Kamsá name of *Methysticodendron*, *mets-kwai borrachero* or *mits-kway borrachero*, means "intoxicant of the jaguar." The term *borrachero* is a loan-word from Spanish, for in southern Colombia and Ecuador a large number of solanaceous narcotics are referred to popularly as *borrachero* (*borracho* = drunken). Notwithstanding the meaning of the Kamsá *mets-kwai*, these Indians refer to the plant in Spanish as *culebra-borrachero* ("intoxicant of the snake") and not as *tigre-borrachero.* Another name which the Kamsá people apply to the plant is *goon'-ssi-an borrachero*, the meaning of which I could never ascertain. The Inga Indians of the Valley of Sibundoy call the plant *kin-de-borrachero.*

I wish to acknowledge gratefully the helpful suggestions of many of my colleagues at Harvard University and elsewhere during my study of the material of *Methysticodendron Amesianum.* My special appreciation to Professor Irving W. Bailey and to Professor Ivan M. Johnston is here expressed. The plates which Mr. Elmer W. Smith has so painstakingly prepared were made possible by a grant from the American Academy of Arts and Sciences.

COLOMBIA: Comisaría del Putumayo, Valle de Sibundoy, Sibundoy, alt. 2225 m. "Treelet 25 feet tall. Cultivated in Indian garden. Used as divinatory narcotic. Flowers white, anthers yellow. *Culebra borrachera.* Kamsá = *mits-kway borrachera.*" June 30, 1953, *Richard Evans Schultes & Isidoro Cabrera 20079* (TYPE in Herb. Gray).—Comisaría del Putumayo, Sibundoy, alt. about 6700 feet. "Treelet 25 feet tall. Flowers pendulous, white. Leaves used to prepare a narcotic drink for use of witch-doctors in divination. Spanish: *culebra borrachera.* Ingano = *kin-de borrachero.* Kamsá = *goon-ssi-an borrachero.*" February 16, 1942, *Richard Evans Schultes 3256.*—Comisaría del Putumayo, Sibundoy, Valle de Sibundoy. "In garden near house of an Indian herb doctor. Erect shrub 3–4 m. tall. Flowers white, somewhat irregular. Plant apparently sterile, as old flowers seem to drop off, and the people say it never sets fruit. *Culebra borrachero* planted here not seen wild.'' March 30, 1943. *F. R. Fosberg 20406.*—Comisaría del Putumayo, al norte de Sibundoy, alt. 2250 m. ''Arbusto de 3 m. Flores blancas. Estambres color gris, anteras amarillas.'' February 21, 1951, *Mardoqueo Villarreal 68.*—Comisaría del Putumayo, al sur de Sibundoy, alt. 2250 m. ''Inga = *boracero.* Kamsá = *nitwaí-boracero.* Arbusto 2 a 3 m. Flores muy jovenes, color verde-claro; adultas blancas.'' February 22, 1951, *Mardoqueo Villarreal 71.*—Comisaría del Putumayo, al sur de Sibundoy, alt. 2250 m. ''Arbusto de 3 m. Flores blancas.'' February 22, 1951, *Mardoqueo Villarreal 72.*—Comisaría del Putumayo, al sur de Sibundoy, alt. 2250 m. ''Arbusto de 3 m. Flores jovenes, color verde-claro; adultas blanco-pálidas.'' February 22, 1951, *Mardoqueo Villarreal 73.*—Comisaría del Putumayo, al sur de Sibundoy, alt. 2250 m. ''Arbusto de 3 m. Flores muy jovenes, color verde-claro; adultas blanco-palidas. Ingano = *culebra borrachero;* Kamsá = *nitkwai boracero.*'' February 22, 1951, *Mardoqueo Villarreal 74.*—Comisaría del Putumayo, camino de Santiago a San Andrés, cerca al Río Quinchoa, alt. 2270 m. ''Ingano = *culebra borrachera.* Árbol de 3 m. Corolo blanco-pálida. Estambres blanco-verdosos; anteras carmelitas.'' February 24, 1951, *Mardoqueo Villarreal 94.*—Comisaría del Putumayo, camino de Santiago a San Andrés, cerca al Río Quinchoa, La Misión, alt. 2270 m. ''Kamsá = *quinchora borrachero.* Arbusto de 2 a 3 m. Flores blancas. Estambres ligamente blanco-violáceas; anteras semi-violáceas.'' February 24, 1951, *Mardoqueo Villarreal 95.*—Comisaría del Putumayo, Valle de Sibundoy, Santiago, alt. ca. 2250 m. ''*Culebra borrachero.* Arbolito ramoso 2–3 m. de alto. Flores blancas. El líquido resultante por la decocción de las hojas lo toman los indígenas para alucinarse.'' September 22, 1953, *A. Fernández 2641.*

PITCH-YIELDING TREES OF THE COLOMBIAN AMAZONIA

BY

RICHARD EVANS SCHULTES

WHILE in the northwest Amazon, I was repeatedly impressed by the important role which various resinous pitches play in the daily lives of the Indians of the area. A study of some of the trees which are most commonly used as sources of pitch has not only yielded interesting ethnobotanical data but has also brought to light several apparently hitherto undescribed specific and varietal concepts.

Sundry resiniferous plants are used by the Indians of the northwest Amazon for domestic purposes. Important amongst these plants are *Couma macrocarpa* Barb.-Rodr. of the *Apocynaceae* (the resin of which is extensively employed in caulking canoes), *Protium heptaphyllum* L. of the *Proteaceae* (the brittle and aromatic resin of which is sometimes added to clay for making pots) and several species of *Manilkara* and *Ecclinusa* of the *Sapotaceae.*

Notwithstanding the utilization of these and other plants, attention in this paper will be directed principally to three closely allied genera of the tribe *Moronobeae* of the *Guttiferae: Moronobea, Platonia* and *Symphonia.* Field studies have indicated that trees of these genera are, for most domestic uses, preferred by the natives of the northwest Amazon over all other species which yield pitch. A review of the literature indicates that the slight amount of attention which these genera have received is hardly commensurate with their economic importance to human life in the Amazon forests. Since the latexes of all three of these genera are similar in consistency and uses (in some cases having the same native name), they are treated here together. It appears, nevertheless, that the several species of *Symphonia* are the most important pitch-plants amongst the Indians of Amazonian Colombia.

Moronobea coccinea *Aublet* Hist. Pl. Guy. Fran. (1775) 788, t. 313 excl. figs. a–f.

Aublet, in describing *Moronobea coccinea* in 1775 ("Histoire des Plantes de la Guyane Française" (1775) 792), stated that the Caribs ("Galibis") utilized the resin of the tree to glue on the points and poisonous teeth of their arrows. The tree as well as its resin was called *mani* in French Guiana. The common name *mani* is likewise employed for the pitch of *Moronobea coccinea* in Surinam (van Cappelle, H.: "Au travers des forêts vièrges de la Guayane Hollandaise" (1905) 26).

Working in the upper Orinoco basin in Venezuela at the turn of the 18th century, Humboldt (Humboldt, A.: "Personal narratives of travels to the equinoctial regions of America" 2 (1900) 357) found the extraction of resin from *Moronobea coccinea* to be a flourishing industry at Javita, a small town on the Río Temi (an affluent of the Río Atabapo). He wrote:

> . . . In the forests of those burning climates (where there is neither pine, thuya, taxodium, nor even a podocarpus), resins, balsams and aromatic gums are furnished by the *Moronobea*, the icica and the amyris. The collecting of these gummy and resinous substances is a trade in the village of Javita. The most celebrated resin bears the name of *mani;* and of this we saw masses of several hundred-weight, resembling colophony and mastic. The tree called *mani* by the Paragınis, which M. Bonpland believes to be the *Moronobea coccinea*, furnishes but a

small quantity of the substance employed in the trade with Angostura. The greatest part comes from the *mararo* or *caragna*, which is an amyris. It is remarkable enough that the name *mani*, which Aublet heard among the Galibis [Caribs] of Cayenne, was again heard by us at Javita, three hundred leagues distant from French Guiana. The *Moronobea* or *Symphonia* of Javita yields a yellow resin; the *caragna*, a resin strongly odoriferous and white as snow; the latter becomes yellow where it is adherent to the internal part of the old bark.

At the hamlet of Pimichín, near Javita, Humboldt spent the night at a pitch-gatherers' camp (*loc. cit.* 368) and was able personally to see evidence of this forest industry:

> We passed the night in a hut lately abandoned by an Indian family . . . A great store of *mani* (a mixture of the resin of the *Moronobea* and the *Amyris Caraña*) was accumulated around the house. This is used by the Indians here, as at Cayenne, to pitch their canoes and fix the bony spine of the ray at the points of their arrows.

The Kubeo and Desano Indians along the Río Vaupés and its Colombian affluents gather quantities of the pitch from *Moronobea coccinea* (which seems to be much more abundant from Mitú downstream than in the headwaters of the river) for making huge torches for the lighting of their large communal houses during tribal dances. Compact lumps of the dried, blackened pitch are heated and applied to the tops of small posts driven into the earthen floor. When ignited, the pitch gives off a surprisingly bright light. The Tanimukas and Yukunas sometimes employ the pitch of this species in the manufacture of dancing-masks, but the preferred resin for this purpose is that from *Symphonia*.

COLOMBIA: Comisaría del Amazonas, Trapecio Amazónico, interior regions of trapecio between Amazon and Putumayo watersheds. Alt. above 100 m. November 1946, *George A. Black & Richard Evans Schultes 46-369.*—Comisaría del Vaupés, Río Vaupés, Mitú and vicinity. Alt. about 250 m. "Columnar tree, 1½ feet in diameter. Height 90 feet. Crown sparse, all at top. Bark thick, soft, roughish, brown outside, sandy inside. Latex abundant, yellow. Wood yellowish white. Flowers rose-red. Tukano = *woo-há-pee-ka-ne;* Taiwano = *go-hé.*" September 8, 1951, *Richard Evans Schultes & Isidoro Cabrera 13960.*—Comisaría del Amazonas, Río Caquetá, La Pedrera and vicinity, Quebrada Tonina. "Large tree. Yukuna = *koo-peé;* Kuripako = *koo-á-see;* Kabuyarí = *maú-pa;* Puinave = *boo-kwan;* Tanimuka = *ree-ká-wa-ree-ka.*" October 5, 1952, *Schultes & Cabrera 17728.*

Moronobea riparia (*Spruce*) *Planchon & Triana* var. **fimbrillata** *R. E. Schultes var. nov.*

Arbor usque ad sexaginta pedes alta, riparia, a *Moronobea riparia* pedicellis multo crassioribus et longioribus, petalis apicem versus conspicue fimbrillatis (non integris), albido-viridibus (non albis) atque latice laete flavo (non viridi) principaliter differt.

The type of *Moronobea riparia* was collected by Spruce along the Río Casiquiare and its affluents in Venezuela, not far from the locality of the three Colombian collections cited below.

An examination of a duplicate type of *Moronobea riparia* (*Spruce 3350*) in the Gray Herbarium shows that the petals do not have the fimbrillate margin near the apex, which is very conspicuous in the Colombian collections upon which I am basing this new variety. This fimbrillate margin, together with the general tendency for the petals to be somewhat greenish and the bright yellow latex, would seem to indicate that we have at hand a geographic variant which is best treated as a variety.

The otherwise excellent drawing of *Moronobea riparia* in Martius' *Flora Brasiliensis* 12, pt. 1 (1886) t. 106 errs in depicting for this species acute petals. The petals in the Gray Herbarium specimen of *Spruce 3350* are broadly rounded, albeit, in aestivation, the imbricate condition of the bud gives the superficial impression of acute petals.

Like that of other species of the genus, the latex of *Moronobea riparia* var. *fimbrillata* is employed for various household uses by the Indians along the Río Guainía.

Because of its very rugose bark, however, it is harder to bleed than *Moronobea coccinea.*

COLOMBIA: Comisaría del Vaupés, Río Guainía, Puerto Colombia and vicinity (opposite Venezuelan town of Maroa). Alt. about 800–850 feet. General location: Lat. 2°40′ N, Long. 67°30′ W. "Flowers greenish white. Stigma and pistil bright green. Latex bright yellow. Bark thick, scaly, dark brown, corky. Tree storied. Height 40 feet. Diameter 14 inches. Kuripako = *ma-rá-ke.* Spanish = *brea.* Geral = *i-rai-kee.*" October 31–November 2, 1952, *Richard Evans Schultes, Richard E. D. Baker & Isidoro Cabrera 18206* (TYPE in Herb. Gray).—Same vicinity and date. "Tree with storied branches. Height 60 feet. Latex yellow. Flowers greenish white. Stigmas bright green. Diameter 18 inches. Bark rough, shaggy, very dark brown. Puinave = *möm.*" *Schultes, Baker & Cabrera 18210.*—Same vicinity and date. Raudal del Sapo. "Tree, 45 feet tall. Branches storied. Latex yellow. Bark thick, corky, shaggy, dark brown. Flowers white, petals slightly green-tinged. Pistil bright green." *Schultes, Baker & Cabrera 18221*

Moronobea riparia (*Spruce*) *Planchon & Triana* var. **piraparanensis** *R. E. Schultes var. nov.*

Arbor viginti quinque pedes alta, riparia, a *Moronobea riparia* foliis majoribus, apice subacutis (nec late rotundatis nec conspicue indentatis) atque floribus majoribus (petalis obliquuo-orbicularibus, 7 cm. × 7 cm.) principaliter differt.

This new variety, like *Moronobea riparia* itself, is conspicuous in the genus in having a curious greenish or greenish yellow latex.

The collection *Schultes & Cabrera 17147* is sufficiently distinct in its leaf and petal characters to warrant varietal recognition. Along the creeks and brooks emptying into the middle course of the Río Piraparaná, *Moronobea riparia* var. *piraparanensis* is rather abundant. The Barasana and Makuna Indians of the region employ the latex for making torches and for caulking canoes.

COLOMBIA: Comisaría del Vaupés, Río Piraparaná, Caño Oomooña. "Small tree on waterside. Height 25 feet. Flowers white, stigma green. Latex greenish yellow. Makuna = *gö-hé-gö*; Barasana = *ö-fé-gö;*

Puinave=*koo-an.*" September 3, 1952, *Richard Evans Schultes & Isidoro Cabrera 17147* (Type in Herb. Gray).

Moronobea rupicola *R. E. Schultes sp. nov.*

Arbor mediocris, usque ad duodecim pedes alta. Truncus aliquid contortus, 8 poll. in diametro, cortice molli, fusco rimosoque, latice copioso, flavo. Ramuli cortice rufo-fusco densissime foliosi, internodiis plusminusve 8 cm. longis. Folia firme subcoriacea, supra nitida atroviridiaque, infra pallidiora, breviter petiolata (petiolis 6–10 mm. longis, aliquid complanatis), obovata, apice brevissime et abrupte acuminata, basi cuneata, margine leviter marginata, usque ad 8–8.5 cm. longa, 4 cm. lata, nervis lateralibus 0.7–1 mm. inter se distantibus. Flores terminales, citrini sed petala basim versus pallide rosea. Pedicelli brevissimi 4–6 mm. longi, crassi, rosei. Sepala valde inaequalia, crasse chartacea; duo exteriora orbiculata, margine integra, conspicue rugulosa, plusminusve 5 mm. longa, 7 mm. lata; interiora similia sed majora, 8 mm. longa, 10–12 mm. lata. Petala cucullata, extus subvelutina, obliquuo-ovata, apice rotundata vel saepe subacuta, margine integra, 3.5–4 cm. longa, 3.5 cm. lata. Discus infrastamineus annularis, inter staminum adelphias in lobulos sanguineos carnosulos tumens. Synandrium plusminusve 2.5 cm. longum, contortum, phalangibus plerumque 3-andris. Ovarium glabrum, obscure sculptum, oblongo-ovoideum, 1.5 cm. longum. Stylus 1.5 cm. longus, in brachia 1–1.5 mm. longa exiens, ultra petala non exsertus. Fructus adhuc ignotus.

Moronobea rupicola appears to be most closely allied to *M. ptaritepuiana* Steyerm., native to Cerro Ptaritepuí in Venezuela, the flora of which has many elements in common with that of Cerro Isibukuri. The former species can be distinguished from the latter at once by its abruptly acuminate (instead of apically rounded)

leaves which are larger, by having three (instead of five) anthers in each staminal bundle, by its much shorter pedicels and by its lemon-yellow and basally pink (instead of greenish white and apically pink) petals.

The bright yellow latex of *Moronobea rupicola* is utilized by the Kabuyarí and Taiwano Indians of the Río Kananarí for making slow-burning torches, which are the source of light at festivals and dances in large communal houses.

COLOMBIA: Comisaría del Vaupés, Río Kananarí, Cerro Isibukuri. Alt. 250–700 m. "Tree 35–40 feet tall. Diameter 8 inches. Latex yellow. Flowers yellow, base of outer part of petals slightly pink-tinged. Half way up the mountain." August 4, 1951, *Richard Evans Schultes & Isidoro Cabrera 13384* (TYPE in Herb. Gray).—Same locality. "Flowers yellow." October 29, 1951, *Schultes & Cabrera 14525*.

Platonia insignis *Martius* var. **formosa** *R. E. Schultes var. nov.*

Arbor enormis, usque ad 90 ped. alta, trunco usque ad 1 m. in diametro, a *Platonia insignis* petalorum parte exposita margine auri usu valdissime revoluta, styli brachiis multo longioribus atque sepalis vulgo minoribus principaliter differt.

It might seem that the differences upon which *Platonia insignis* var. *formosa* are based are trivial. The peculiar folding back of the exposed parts of the imbricated petals, however, is so conspicuous that it lends the flowers a very distinctive appearance. There is occasionally some slight folding back of the petals in *Platonia insignis*, but an examination of ample material from Brazil, the Guianas and Venezuela and a study of the description and drawing in Martius' *Flora Brasiliensis* convince me that usually the petals are not at all revolute and that, in those few cases where they are, this condition is slight and wholly confined to the very margin. In the variety here described, the folding back is, as I have stated in the diagnosis, "in the manner of an ear," the rolled-back portion measuring from 5 to 8 mm. in width from the edge, in material preserved in alcohol.

The fruit of *Platonia insignis* var. *formosa* is a large, fleshy, edible bacca. It is a favorite food of the Indians in season and, for this reason, the tree is always spared when new plots are being cleared for agriculture. The extraordinarily abundant, thick, yellow resin is employed in much the same ways as the resinous latexes of *Moronobea* and *Symphonia*.

COLOMBIA: Comisaría del Vaupés, Río Piraparaná (tributary of Río Apaporis), Raudal Guá-kö-nõ-ta. General location: Between Lat. 0°15′ S, Long. 70°50′ W and Lat. 0°25′ N, Long. 70°30′ W. "Flowers rose-red. On sand at river's edge. Latex yellow. Stamens bright yellow. Makuna = *gõ-hé-ree-ka;* Puinave = *kö.*" September 4, 1952, *Richard Evans Schultes & Isidoro Cabrera 17168* (TYPE in Herb. Gray). —Same locality, Raudal de la Olla. "Tree 25 m. Columnar. Bark grey-brown, rough with scales. Flowers salmon-pink. Petals curl out at edge. Receptacle thick, same colour. Latex cream-coloured. On rocks at falls. Crown not large. Tanimuka = *oo-ká-o-ree-ke;* Yukuna = *he-pé-la.*" August 28, 1952, *Schultes & Cabrera 17062.*—Same locality, Raudal Koro. "Same as *17062*, but flowers lighter salmon and wings of petals pale violet. Latex yellow. Tall tree." August 30, 1952, *Schultes & Cabrera 17089.*—Comisaría del Vaupés, Río Vaupés, between Mitú and Javareté, Araracachivera. "Low tree. Latex yellow. Flowers salmon-pink. Pedicel fleshy." May 14–24, 1953, *Schultes & Cabrera 19395.*

Symphonia globulifera *Linnaeus fil.* Suppl. (1781) 302.

Im Thurn, the explorer of British Guiana, reported (Holland, J. H.: "The useful plants of Nigeria" in Kew Bull. ad. ser. 9, pt. 1 (1908) 62) that a wax prepared by mixing the resin of *Symphonia globulifera* with bees' wax and charcoal was employed by the Indians of British Guiana for cementing arrow heads and joining wood.

In Costa Rica (Pittier, H.: "Plantas usuales de Costa Rica" (1908) 80), the resin of *Symphonia globulifera* is mixed with wax and employed in making candles and as a caulking pitch.

According to Corrêa (Corrêa, P.: ''Flora do Brasil'' (1909) 15), the resin of *Symphonia globulifera* finds medicinal, veterinary and industrial uses in Brazil. Likewise it is valued in caulking and as a substitute for cobblers' wax (''A glossary of useful Amazonian flora'' Coord. Inter-Amer. Aff. (mimeographed) p. 6). In Colombia, the resin, which is known as *paramán* and in the Amazonian regions as *brea*, is used for caulking the seams of boats (Pérez-Arbeláez, E.: ''Plantas útiles de Colombia'' (1947) 381). In the Peruvian Amazon, *Symphonia globulifera* is known as *brea-caspi* (''pitch tree'') (Williams, L.: ''Woods of northeastern Perú'' in Field Mus. Nat. Hist. Bot. Ser. 15 (1936) 343).

The abundant, thick yellow latex of *Symphonia globulifera* is gathered in large quantities by the Makuna and Barasana Indians of the Río Piraparaná and the lower Apaporis basin for use in making torches and dancing masks, for caulking dugout canoes and for finishing the ends of poison dart quivers made of *Ischnosiphon* stems. It is also employed as a general-purpose glue in making many household articles, such as the hollow bird-bone snuffing tubes and snail-shell snuff-cases.

In the Puinave language, *Symphonia globulifera* is known as *kö*, an epithet which is sometimes applied to other species of the same genus.

Colombia: Comisaría del Vaupés, Río Piraparaná, Caño Oo-moo-ña. ''Large tree. Height 60 feet. Flowers red. Latex yellow. Bark brown. Puinave=*kö*.'' September 3, 1952, *Richard Evans Schultes & Isidoro Cabrera 17163*.

Symphonia microphylla *R. E. Schultes sp. nov.*

Arbor parva, usque ad quadraginta quinque pedes alta, debilis sed erecta, copiose resiniflua, latice flavo. Rami late strato-patentes. Ramuli teretes, cortice cinereo, dense foliati. Petiolus crassiusculus, 3–4 mm. longus. Folia rigide subcoriacea, supra nitida et atroviridia, infra pallidiora, oblanceolata, apice obtusa, basi cuneata, margine valde revoluta, plerumque 4.5 cm. longa, 1.5 cm. lata, nervis lateralibus numerosis, supra obscuris sed infra prominulis, inter se 0.5–1 mm. distantibus. Inflorescentiae abbreviatae, in ramulis lateralibus sessiles, umbelliformes, ramulis floriferis dense foliatis. Pedicelli in quoque fasciculo 6–8, straminei, plusminusve 8 mm. longi, basi bracteolis minutis, usque ad 1 mm. longis. Alabastrum subglobosum, 5–6 mm. in diametro. Sepala purpurea, subaequalia, subcrassa, late ovata, apice rotundata, margine integra, circiter 2 mm. longa, 2–2.2 mm. lata. Petala sanguinea apicem versus saepe purpurea, aestivatione non contorta, firme membranacea, valde cucullata, orbicularia, 9 mm. lata, margine integra, 8–9 mm. longa, utrinque glaberrima. Discus extrastaminalis 1.2–1.5 mm. altus, valde incrassatus. Synandrium atropurpureum, tubo lageniformi petalis subaequali, 6–7 mm. longum, laciniis maxime crassissimis, rugosis, lineari-triangularibus, stylum versus arcuatis, transversale triangularibus, 2–2.3 mm. longis, 1.8 mm. latis, parte tubiformi 3–3.2 mm. longa, antheris linearibus, ternis, flavis, 1.8 mm. longis, 0.6 mm. latis. Ovarium glabrum, oblongo-ovoideum, 2.8 mm. longum, 1.8 mm. in diametro, in stylum 4 mm. longum, apice profunde stellatim quinquedivisum, brachiis crassissimis, 2.2 mm. longis, attenuatum. Fructus adhuc ignotus.

Symphonia microphylla can be distinguished at once from the other two species of the genus through its very small, oblanceolate, obtuse leaves which are not grouped exclusively at the tips of the branchlets but are borne more or less along most of their length. The flowers are smaller than those of *Symphonia globulifera*, and the umbels are fewer-flowered and less dense than those of *S. utilissima.* In floral structure, the lobes of the synangium are much fleshier, and the stigma-bearing arms of the style are much more carnose and longer than in either *Symphonia globulifera* or *S. utilissima.*

The resinous pitch obtained from *Symphonia microphylla* is employed by the Taiwano and Kabuyarí Indians of the Río Kananarí for the same purposes as that of *S. globulifera.*

COLOMBIA: Comisarías del Vaupés and Amazonas, Río Apaporis, Raudal de Jirijirimo. "Flowers red. Tree, 45 feet tall. Latex yellow, used as brea. Puinave = *kö;* Yukuna = *main;* Kuripako = *maí-ne.*" November 27, 1951, *Richard Evans Schultes & Isidoro Cabrera 14662* (TYPE in Herb. Gray).

Symphonia utilissima *R. E. Schultes sp. nov.*

Arbor parva, usque ad quadraginta quinque pedes alta, nunc gracilis et inter vicinas subscandens vel eis suffulta, nunc robustior et erecta, copiose resiniflua, latice flavo. Rami late strato-patentes. Ramuli teretes, cortice cinereo, apice dense foliati, internodiis 15–17 cm. longis. Petiolus leviter canaliculatus, 4–5 mm. longus. Folia subcoriacea, supra nitida et atroviridia, infra pallidiora, elliptica, longe acuminata, basi cuneata, 6–7 cm. longa, 2–2.3 cm. lata, nervis lateralibus numerosis, inter se plusminusve 1 mm. distantibus, utrinque aequaliter prominulis. Inflorescentiae abbreviatae, in ramulis lateralibus sessiles, umbelliformes, ramulis floriferis dense foliatis, internodiis brevibus, 4–5 cm. longis. Pedicelli in quoque fasciculo saepissime 8–12, flavo-virides, 8–10 mm. longi, basi bibracteolati bracteolis sanguineis, minutissimis. Alabastrum globosum, 4–6 mm. in diametro. Sepala subcoriacea, roseo-violacea, suborbicularia, plusminusve 3 mm. longa, 4 mm. lata. Petala aliquid crassa, sanguinea, aestivatione contorta, valde cucullata, orbicularia, 6–8 mm. longa et lata, margine integerrima, extus parte inclusa levi, exposita crassiore atque rugulosa. Discus extrastaminalis 0.8–1 mm. altus. Synandrium sanguineum, tubo lageniformi quam petala breviore, 4 mm.

altum, laciniis linearibus, acutis, rugulosis, 2.5 mm. longis, 1 mm. latis, parte tubiformi 2 mm. longa, antheris linearibus, ternis, flavis, 1.2 mm. longis, 0.5 mm. latis. Ovarium glabrum, subglobosum, plusminusve 1.2 mm. in diametro, in stylum 2 mm. longum, apice stellatim quinquefidum, brachiis crassis, 1 mm. longis, attenuatum. Fructus adhuc ignotus.

Symphonia utilissima differs from *S. globulifera* in its smaller, elliptic, very long-acuminate (instead of oblong or oblong-lanceolate, short-acuminate) leaves and in its much smaller flowers which are grouped more densely in umbels of from eight to twelve (instead of from three to seven).

This tree is of prime importance in the economy of the natives of the Apaporis basin. Its abundant yellow latex is gathered for use in caulking dugout canoes, and the Makuna, Tanimuka and Yukuna Indians make dancing-masks from the pitch which, when boiled, becomes black, and hardens into a firm, brittle and glossy material. The pitch from *Moronobea coccinea* is likewise used in the manufacture of the dancing masks, but *Symphonia utilissima* appears to be much more abundant in the flood-forests and more easily bled than *M. coccinea.*

COLOMBIA: Comisaría del Vaupés, Río Apaporis, Jinogojé. "Small tree. Flowers red. Latex yellow. Highland. Spanish = *brea;* Tanimuka = *ma-ñé* and *ree-ka-vá;* Yukuna = *main;* Puinave = *kö* and *kö-lõ;* Kuripako = *maí-ne;* Makuna = *go-hé-ree-ka.*" August 17, 1952, *Richard Evans Schultes & Isidoro Cabrera 16885* (TYPE in Herb. Gray).

EXPLANATION OF THE ILLUSTRATION

PLATE V. (*Upper*) Flowering branch of *Moronobea riparia* (Spruce) Planchon & Triana var. *fimbrillata* R. E. Schultes. Río Guainía, Vaupés, Colombia.

(*Lower*) Flowers of *Moronobea coccinea* Aublet from the tree which gave the collection *Schultes & Cabrera 13960.* Mitú, Río Vaupés, Vaupés, Colombia.

Photographs by RICHARD EVANS SCHULTES

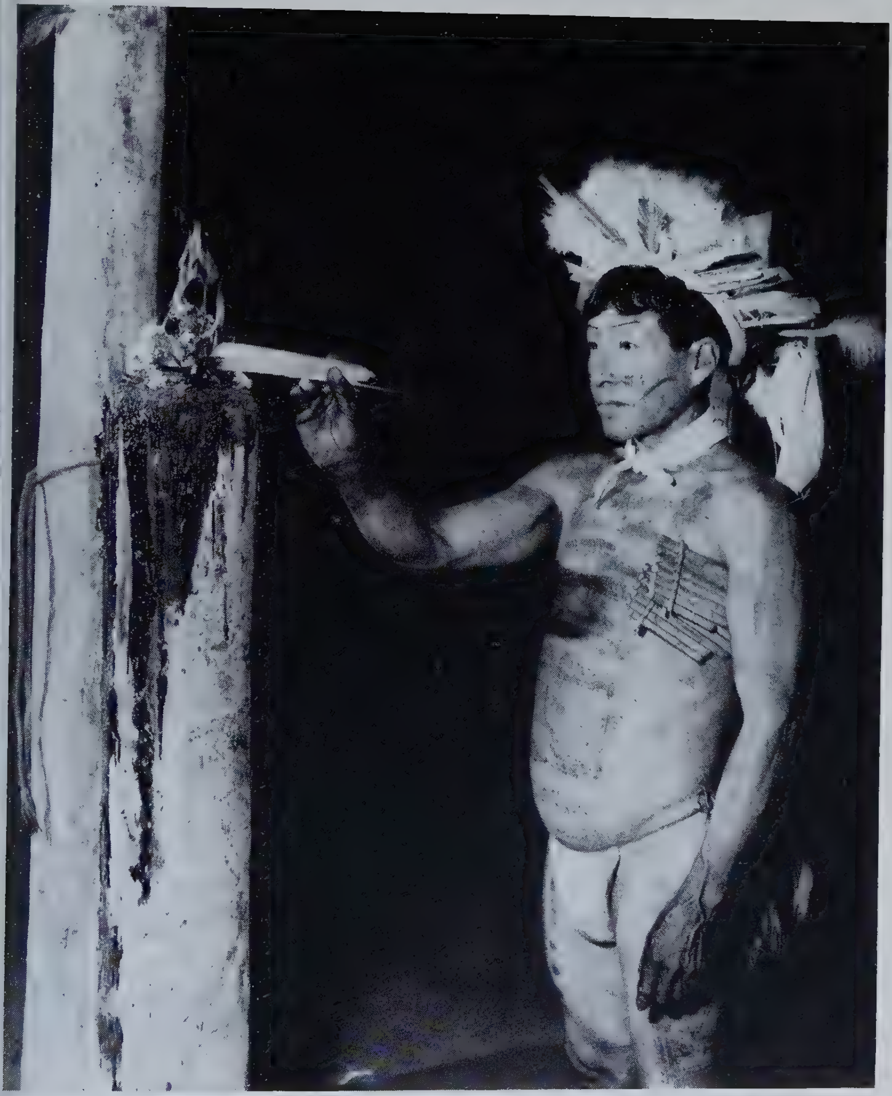
PLATE V

EXPLANATION OF THE ILLUSTRATION

Plate VI. Kubeo Indian lighting torch made from the resin of *Moronobea coccinea* Aublet. Río Vaupés, Vaupés, Colombia.

Photograph by Lee Salsbery

PLATE VI



EXPLANATION OF THE ILLUSTRATION

PLATE VII. Flowering branches of *Moronobea rupicola* R. E. Schultes from the tree which furnished the type material. Cerro Isibikuri, Río Kananarí, Vaupés, Colombia.

Photograph by RICHARD EVANS SCHULTES

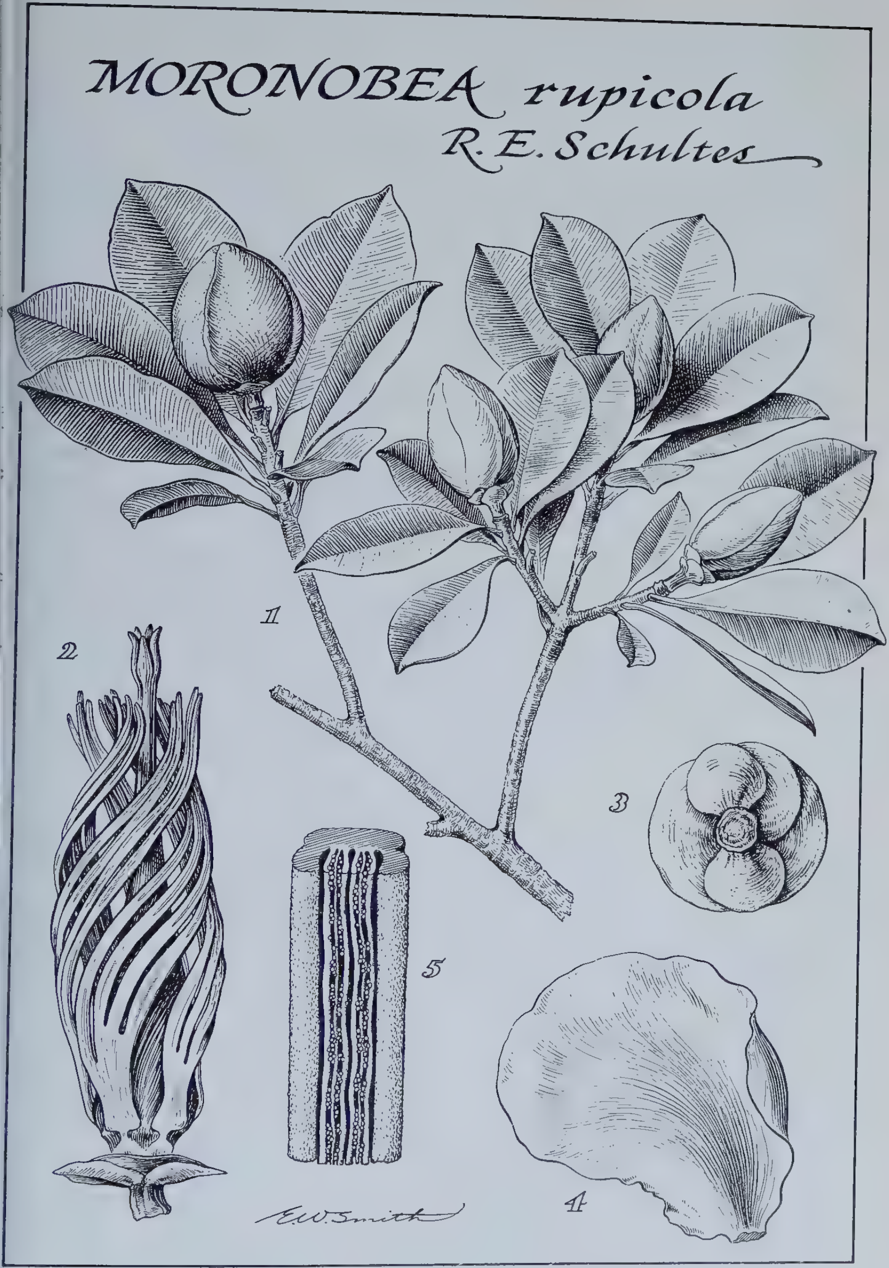
PLATE VII

EXPLANATION OF THE ILLUSTRATION

Plate VIII. Moronobea rupicola *R. E. Schultes.* 1, flowering branch, about one half natural size. 2, flower with petals removed, about one and one half times natural size. 3, underside of calyx, about one and one half times natural size. 4, petal, natural size. 5, section of an anther, fifteen times natural size.

Drawn by Elmer W. Smith

PLATE VIII



EXPLANATION OF THE ILLUSTRATION

PLATE IX. PLATONIA INSIGNIS *Mart.* var. FORMOSA *R. E. Schultes.* (*Upper*) Branches showing fertilized flowers with the petals fallen and the staminal bundles drooping. From the type tree. Río Piraparaná, Vaupés, Colombia.

(*Lower*) Flowers of the type tree before fertilization.

Photographs by RICHARD EVANS SCHULTES

PLATE IX

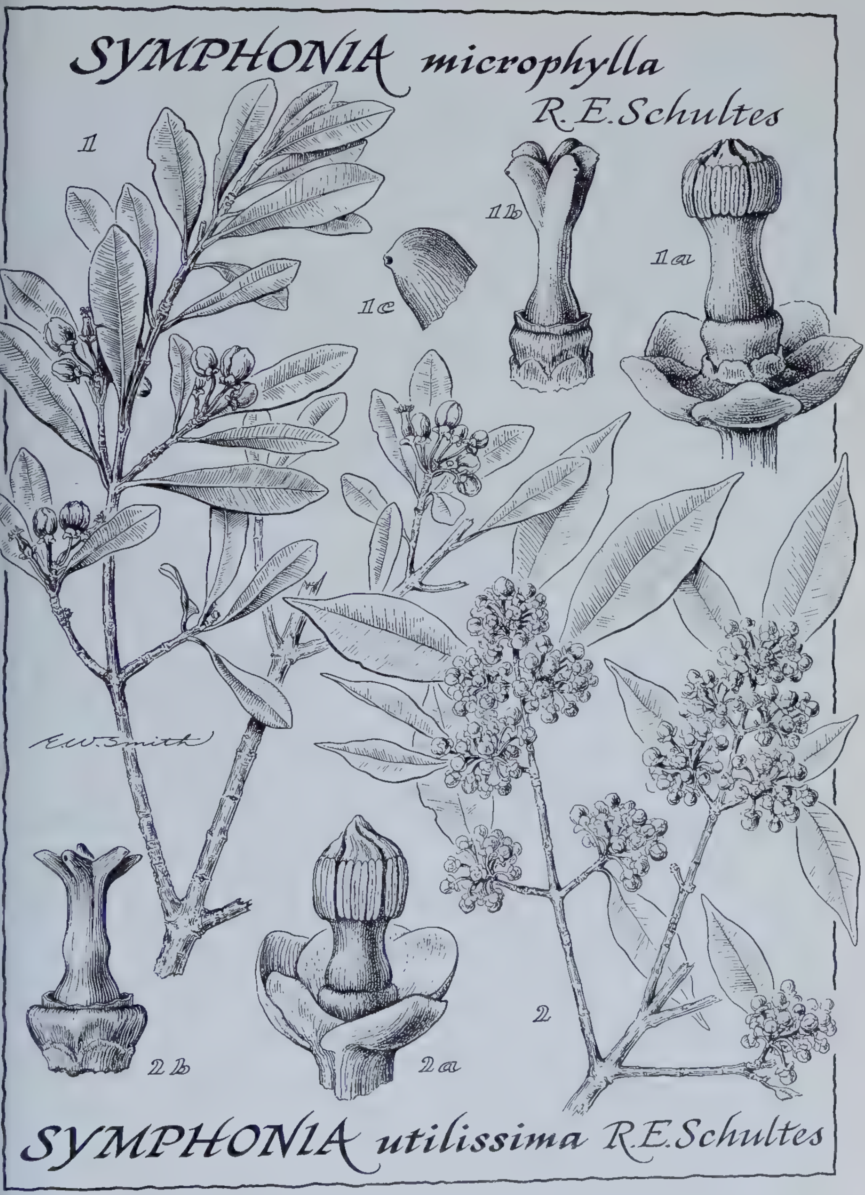
EXPLANATION OF THE ILLUSTRATION

Plate X. Symphonia microphylla *R. E. Schultes.* 1, flowering branch, one half natural size. 1a, flower with the petals removed, about five times natural size. 1b, pistil, about five times natural size. 1c, tip of stigma arm showing stigmatic surface, about ten times natural size.

Symphonia utilissima *R. E. Schultes.* 2, flowering branch, one half natural size. 2a, flower with the petals removed, about five times natural size. 2b, pistil, six times natural size.

Drawn by Elmer W. Smith

PLATE X

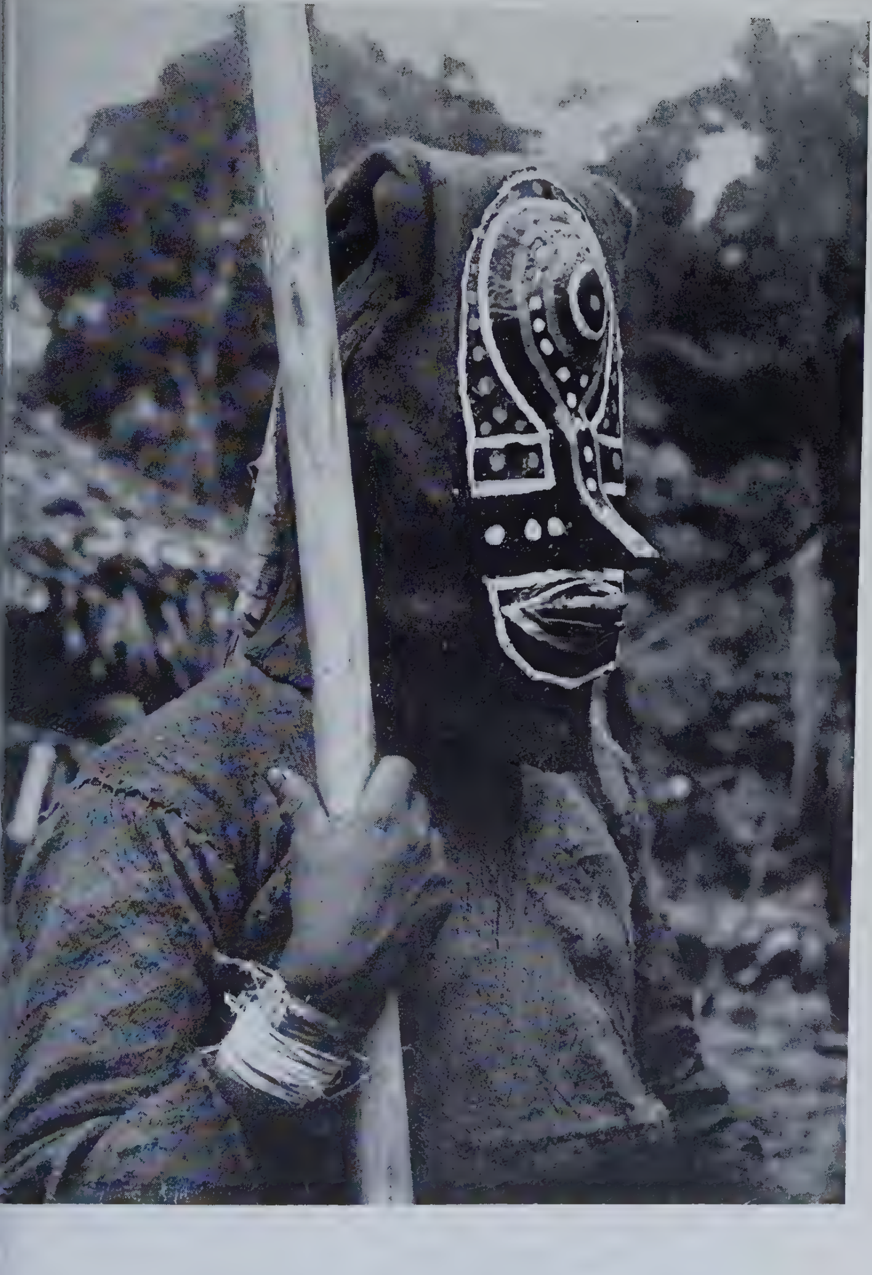

SYMPHONIA microphylla
R.E.Schultes
1
1b
1a
1c
E.W.Smith
2
2b
2a
SYMPHONIA utilissima R.E.Schultes

EXPLANATION OF THE ILLUSTRATION

Plate XI. Yukuna dancing-mask made from the resin of *Symphonia utilissima* R. E. Schultes. Río Miritiparaná, Amazonas, Colombia.

Photograph by Richard Evans Schultes

LATE XI



A NOTE ON THE GENUS JOANNESIA

BY

RICHARD EVANS SCHULTES

Joannesia princeps *Velloso* Alograf. (1790) 199.

Joannesia insolita Pittier in Bol. Soc. Venez. Cienc. Nat. 6, no. 41 (1939) 8.

In 1939, Dr. Tobias Lasser collected specimens from a tree in the yard of an abandoned house at El Peaje, along the road out of Caracas towards El Valle in Venezuela. The tree was determined as belonging to the genus *Joannesia* by Dr. Pittier who sent material to Dr. Adolpho Ducke for study.

Joannesia, had previously been known only through *J. princeps* Vell., from the coastal regions of Brazil near Rio de Janeiro, and *J. heveoides* Ducke, from the central part of the Amazon Valley. The discovery of the genus in such a distant and isolated locality as Caracas, Venezuela, was, indeed, unexpected.

Both Pittier and Ducke felt that the Venezuelan material represented a distinct species, possibly allied more closely to *Joannesia princeps.* Pittier, consequently described it as *Joannesia insolita.* In discussing the novelty, he wrote (*loc. cit.* 10): "The question still to be resolved is 'How did this, the only known individual of the species, get to its present location?' and also 'How can one explain why, in so many trips through the forests of the coastal mountains and others that surround Caracas, none of the numerous students of our flora has met with a tree which is so unusually conspicuous?' "

A study of the type and other material from the Herbario Nacional de Venezuela, kindly sent to me on loan by Dr. Lasser, convinces me that *Joannesia insolita* must be reduced to synonymy under *J. princeps*. None of the several characters pointed out by Pittier as setting *Joannesia insolita* apart from *J. princeps* is of a major category. All are so slight that, in a group such as the *Euphorbiaceae*, they cannot be accepted as representing more than normal variations within a species. This interpretation would seem to be even more justified when one considers the significant altitudinal and habitat differences between the Caracas locality (850 m.) and the natural area of *Joannesia princeps* in the vicinity of Rio de Janeiro. Indeed, the Venezuelan material is a rather close match for some of the collections of *Joannesia princeps.*

Since the type and only tree of *Joannesia insolita* was found growing in an abandoned yard and since no other individuals have ever been found in the forests of the region, we are probably warranted in assuming that it was planted. There should be no difficulty in explaining how the tree came to be in Caracas. It is apparent that, in the 19th century, living material of *Joannesia princeps* was distributed from Rio de Janeiro to botanical gardens in widely separated areas. In the Gray Herbarium, for example, there is a specimen of *Joannesia princeps* collected in the Calcutta Botanical Garden. Consequently, I see no reason why *Joannesia princeps* could not have been introduced into Venezuela.

A NEW GENERIC CONCEPT IN THE EUPHORBIACEAE

BY

RICHARD EVANS SCHULTES

AN intensive investigation of *Hevea* (the genus of the commercial rubber tree) and its nearest relatives, which has been in progress in the Amazon forests during the past ten or twelve years, has added immeasurably to our understanding of the composition, distribution and possible evolutionary history of these groups. Results of this work have been appearing sporadically and have strengthened our belief that *Hevea* and *Micrandra* are close allies,[1] and may have had a more or less parallel evolution[2]; that both are related to the rather anomalous *Joannesia*[2]; and that the generic concept which had hitherto been known as *Cunuria* cannot be maintained as separate from *Micrandra*.[3] It is, therefore, of considerable interest that a new genus of the *Hevea-Micrandra-Joannesia* complex has now come to light.

Vaupesia *R. E. Schultes gen. nov. Euphorbiacearum.*

Arbores magnae, elatae, parco cum succo lacteo (vel

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[1] This relationship was, apparently, first expressed by Bentham in 1880 (in Journ. Linn. Soc. Bot. 17 (1880) 262): "*Cunuria, Micrandra, Hevea* and *Joannesia* may be to a certain degree related to each other."

[2] Baldwin: in Journ. Hered. 38 (1947) 54–64; Baldwin: in Am. Journ. Bot. 34 (1947) 265; Baldwin and Schultes: in Bot. Mus. Leafl. Harvard Univ. 12 (1947) 325–326.

[3] Schultes: in Bot. Mus. Leafl. Harvard Univ. 15 (1952) 201–222.

saepissime apparenter absenti), foliis alternis, petiolatis, stipulis infraaxillaribus folia juniora involventibus caducis. Folia integra, penninervia, coriacea, pagina supra basim biglandulosa, costis secundariis angulo amplo decurrentibus, arcuatis, tertiis subparallelis. Inflorescentiae bisexuales, paniculiformes, valde floribundae. Pedunculi axillares et terminales, foliis subaequales vel breviores, rigidi. Flores monoeci, petaliferi. Flores staminati; sepala quinque, valde imbricata, quincuncialia; petala calycis lobis alternantia; disci glandulae quinque, vulgo liberae, petalis alternantes. Antherae in columna centrali verticillatim insertae, inferiores disci lobis alternantes, birimosae. Flores pistillati: sepala quinque, eis maris similia; discus hypogynus annularis vel subannularis, glanduloso-lobatus; ovarium liberum, triloculare, loculis uniovulatis; stylus sessilis, tripartitus divisionibus bifidis, erectis vel leviter patentibus. Fructus capsularis; capsula magna, subglobosa, in coccos bivalves partiens, epicarpio carnoso et endocarpio crasso lignoso. Semina magna, ovoidea, testa crustacea, immaculata, ecarunculata; albumen carnosum; cotyledones planae, latae.

Generis species typica: *Vaupesia cataractarum.*

Generis nomen regionem in qua haec arbor reperta est perstringit.

Vaupesia cataractarum *R. E. Schultes sp. nov.*

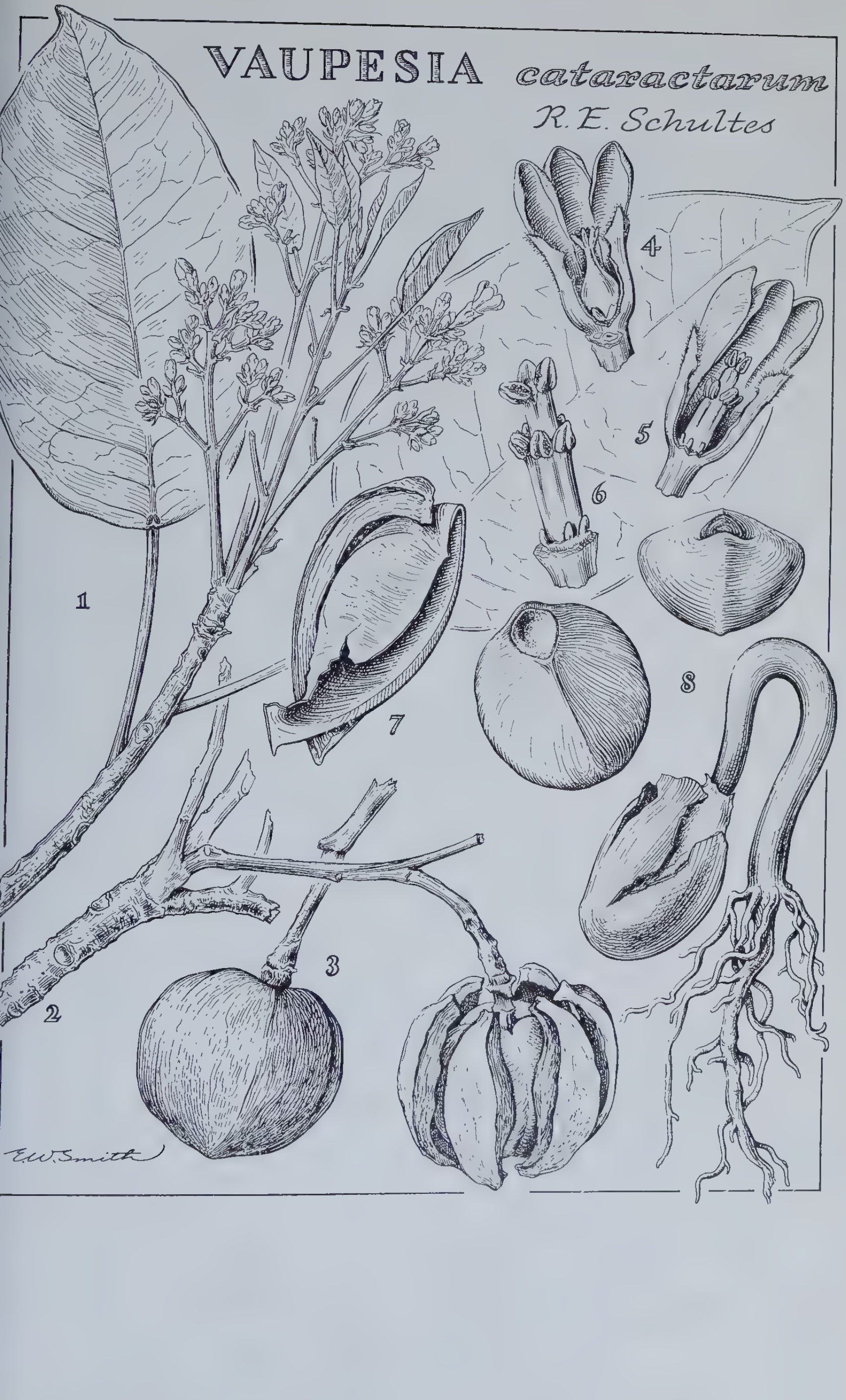
Arbor usque ad sexaginta ad octoginta pedes alta (saepe minor) et usque ad decem pollices in diametro. Truncus erectus, columnaris, sine radicibus tabularibus, tenui cum cortice flavo-cinereo vel albido-cinereo, exfoliato; succo aquoso valde sparsissime lacteo-albo vel frequenter sanguineo, siccitate aliquid cretaceo (vel saepe apparenter absenti). Rami saepe succo amplo aquoso sanguineo instructi, teretes, tenui cum cortice albido-luteo obtecti. Folia valde crasso-coriacea, supra atroviridia laetaque, infra pallidiora hebetiaque, perfecte nervum centralem versus angulo 90° plicata, ovata vel rarenter elliptico-ovata, omnino glaberrima, in specimine typico 16–19 cm. longa, plusminusve 10 cm. lata, apice breviter acuminata vel saepe obscurissime subacuta, basi vulgo perfecte rotundata, valde et conspicue marginata, venis supra non conspicuis sed infra elevatis, secundariis decem ad duodecim leviter arcuato-adscendentibus, tertiis reticulatis subparallelis, glandulis magnis, oblongis, usque ad 4 mm. longis; foliis juvenilibus papyraceis, lineari-lanceolatis, apice acuminatis, basi cuneatis, marginatis, 20–27 cm. longis, 5.5–8 cm. latis. Petiolus tenuis, siccitate striato-fibrosus, 6–9 cm. longus (saepe longior), usque ad 3 mm. in diametro. Inflorescentiae rigidae, plerumque 9–13 cm. longae, rhachide glabra, cortice rufo-purpureo. Bracteae flores subtendentes stramineae, acuto-subulatae vel late triangulares, plerumque 4–5.5 mm. longae, basi 2.5–3.5 mm. latae, glabrae sed apicem versus saepe minute rufo-barbellatae. Flores lutei, in sole valde aromatico-pungentes, terminales majores saepissime pistillati sed saepe staminati. Flores pistillati: apice usque ad 5–6 mm. in diametro, calyces 10 mm. longi, extus minutissime scobiculato-pulverulenti, intus glaberrimi, $\frac{1}{3}$ partis divisi, laciniis margine conspicue ciliato-fimbriatis, tres exteriores majores, rhombico-spathulati cum apicibus lateraliter contiguis, subcucullati, apice rotundati sed in anthesi nunc vi fissi, 4 mm. longi, 3.5 mm. lati, duo interiores ovati, 3 mm. longi, 2–2.5 mm. lati; petala membranacea, obovata, 9 mm. longa, 4.5 mm. lata, apice leviter subcucullata, margine integra; discus hypogynus ovario adnatus, quinquelobatus, lobis variabilibus sed saepissime late rotundatis vel triangulari-subulatis, 1 mm. longis, 0.5–1 mm. latis, basi in vivo apparenter sanguineus; ovarium longe pyramidali-conicum, subtrigonum, glabrum, 4.5 cm. longum, plus-

EXPLANATION OF THE ILLUSTRATION

PLATE XII. VAUPESIA CATARACTARUM *R.E.Schultes.* 1, flowering branch, about one half natural size. 2, fruiting branchlet, with capsule ready for dehiscence, about one half natural size. 3, capsule before the drying out of the epicarp, about one half natural size. 4, pistillate flower with part of calyx and two petals removed, about two and one half times natural size. 5, staminate flower with part of the calyx and two petals removed, about two and one half times natural size. 6, staminal column with anthers, about four times natural size. 7, one valve of the capsule with epicarp adhering, about natural size. 8, seeds, with one germinating, about natural size.

Drawn by ELMER W. SMITH

PLATE XII

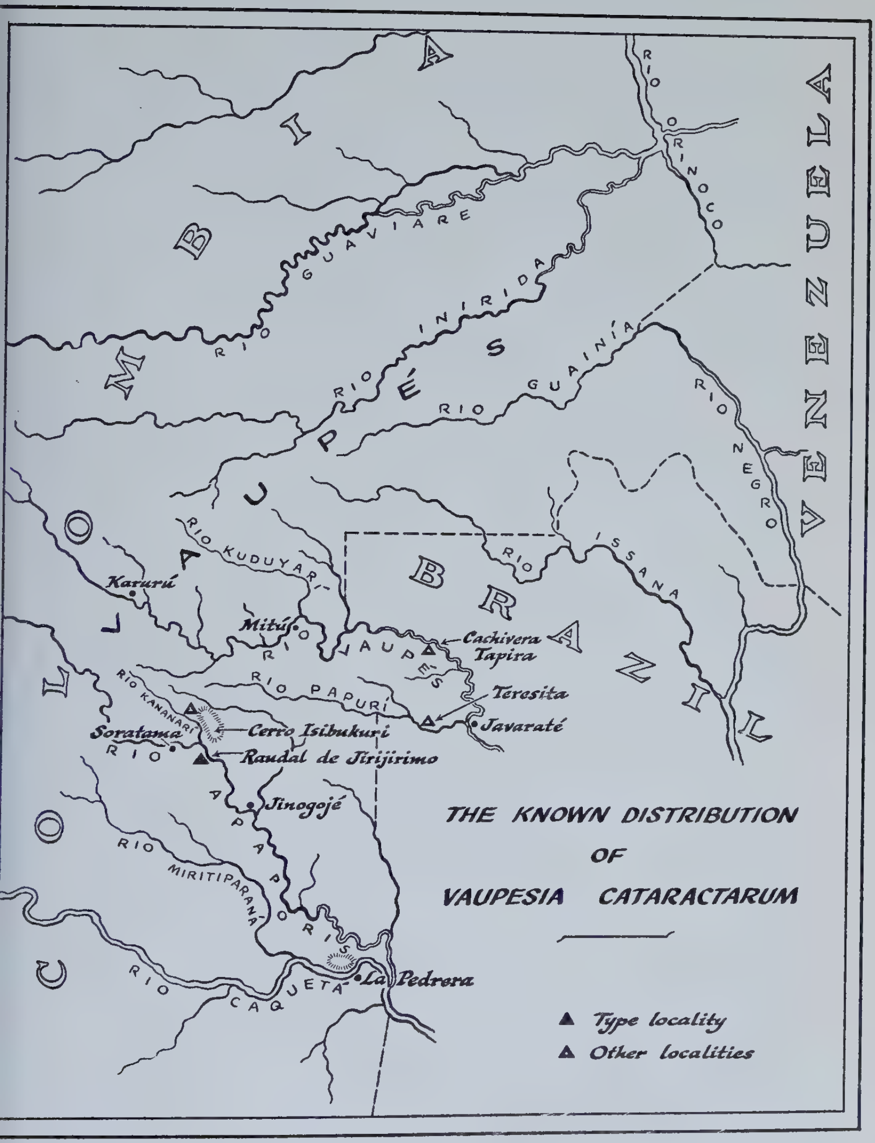


EXPLANATION OF THE ILLUSTRATION

Plate XIII. Map showing the known distribution of *Vaupesia cataractarum.*

Drawn by Elmer W. Smith

PLATE XIII



THE KNOWN DISTRIBUTION OF VAUPESIA CATARACTARUM

minusve 2 mm. in diametro; stylus tripartitus cum divisionibus bifidis, erectis, 1.5 mm. longis. Flores staminati: terminales pistillatis similes, laterales structura aequales sed partibus omnibus minores; florum staminatorum terminalium disci glandulae ad columnae staminalis basim insertae, parvae, erectae, oviformi-ellipsoideae, 0.5 mm. longae vel breviores; columna crassissima, usque ad 10 mm. longa, basi plusminusve 1.5 mm. in diametro, supra verticillum inferiorem 1 mm. in diametro sed omnino cylindrica, non attenuata; antherae octo, quinque in verticillo inferiore, ad columnae basim 3–3.5 mm., et tres in verticillo ad columnae apicem, aequales, 0.8–1 mm. longae. Fructus globosus vel subglobosus, vivo plusminusve 5 cm. longus, 4.8–5 cm. in diametro, siccitate vix minor, apice rotundato-obtusus, basi aliquid depressus, epicarpio nitido, atroviridi, saepe maturitate paulo purpurascenti, magnopere crassissimo (vivo saepe 6 mm. crasso), endocarpio lignoso, comparate tenui (usque ad 2.5–3 mm. crasso), valvis regularibus, plerumque 4.5 cm. longis, 2 cm. latis; pedunculo vulgo longissimo, robusto, usque ad 8–12 cm. longo, 4 mm. in diametro. Semina cum testa rufo-brunnea et conspicue hebeti, in circuitu longitudinali rotundato-ovalia, plusminusve 30 mm. longa, 26 mm. lata, compressa, 18 mm. crassa, in circuitu transversali inaequaliter rhomboidea, superficiebus duabus ventralibus conspicuis, carina dorsali prominenti, hyli cicatrice conspicua, subrotundata vel subtriangulari, 6–7 mm. longa lataque, prope apicem cicatricum versus rostello instructa.

COLOMBIA: Comisarías del Amazonas and Vaupés, Río Apaporis, Cachivera de Jirijirimo and vicinity. Altitude about 800 feet. "Tree 50–55 feet tall. Diameter 8–10 inches. Flowers yellowish. Latex chalky white. Bark flaky, grey-white. Leaf like *Cunuria Spruceana* with which it grows. Common." September 16, 1951, *Richard Evans Schultes & Isidoro Cabrera 14006* (TYPE in Herb. Gray).—Same locality. "Tree 60 feet tall. Diameter 1 foot. Bark greenish grey. No

latex." June 12, 1951, *Schultes & Cabrera 12431.*—Comisaría del Vaupés, Río Kananarí, Cerro Isibukuri, at base of mountain. Quartzite. Altitude about 800 feet. "Large tree. Bark whitish grey, rough. Latex very watery, reddish." August 4, 1951, *Schultes & Cabrera 13339.*—Same locality. "Tree 100 feet tall. Latex red only in the branches." January 23–25, 1952, *Schultes & Cabrera 15059.*—Comisaría del Vaupés, Río Vaupés, between Mitú and Javareté, Raudal de Tapira. In rocky high land covered with humus along rapids. "Fluted tree. Diameter 26 inches. Bark yellowish, tawny, papery, peeling easily. Inner bark reddish. No latex. Wood hard, centre reddish brown. Height 80 feet. Crown large. Leaves folded at right angles along midrib, slightly paler beneath, somewhat crassulent or fleshy. Bark on extreme branches whitish yellow. Seeds brown, dull. Capsules with thin woody wall, thick epiderm green but reddening before breaking. Desano = *ma-há-wa-soo.* Together with *Micrandra Spruceana* and *Hevea pauciflora* var. *coriacea.*" May 14–24, 1953, *Schultes & Cabrera 19344.*—Same locality and date. *Schultes & Cabrera 19345, 19346, 19347, 19353.*—Comisaría del Vaupés, Río Papurí, Teresita. Caatinga forest. "Large columnar tree; diameter 18 inches; height 60 feet. Crown large. No latex. Bark papery, yellowish grey." May 27, 1953, *Schultes & Cabrera 19440.*—Same locality and date. "Large columnar tree, 60–70 feet tall. Crown large. No latex. Seeds eaten after boiling." *Schultes & Cabrera 19444.*—Same locality and date. *Schultes & Cabrera 19451.*

All of the collections cited above are from Colombian territory, but, in several cases, they were made along rivers (the Vaupés and the Papurí) forming part of the boundary between Colombia and Brazil. I have seen hundreds of trees of *Vaupesia cataractarum* on the Brazilian bank, so we must report this species as occurring in both countries. It might, also, later be found in that part of Venezuela adjoining the Río Negro and the Río Guainía, even though relatively intensive studies of *Hevea* and *Micrandra* in that area have not, as yet, disclosed its presence there.

When I first met with *Vaupesia* in the field, I thought that I had found a new species of *Micrandra* (including *Cunuria*), notwithstanding the presence of petals. The general habit and appearance of the tree is, indeed, so

EXPLANATION OF THE ILLUSTRATION

Plate XIV. Trunk of the tree from which the type of *Vaupesia cataractarum* was taken.

Photograph by Richard Evans Schultes

strikingly similar to several of the species of *Micrandra* with which it grows that even the Indians of the region use the same name for *Vaupesia cataractarum* and for *Micrandra Rossiana* R. E. Schultes and *M. Spruceana* (Baill.) R. E. Schultes. Close examination, however, discloses the extraordinary distinctness of the new concept.

All of the characters of *Vaupesia* place it in the *Micrandra-Hevea-Joannesia* complex. The leaves are very definitely micrandroid, departing sharply from the three-foliolate leaves of *Hevea* and the usually five-foliolate ones of *Joannesia*. The capsule, valves and seeds of *Vaupesia* likewise resemble those of *Micrandra* very strongly. Indeed, if I had collected nothing but fruiting material, I would, without hesitation, have described it as a new species of *Micrandra*.

The type of inflorescence and the petaloid flowers resemble those of *Joannesia* to a remarkable degree, even though the calyx is quite micrandroid and entirely unlike the undivided calyx of *Joannesia*. The presence of a watery red resinous liquid in the bark of many trees of *Vaupesia* recalls a similar condition in *Joannesia heveoides* Ducke.

The whorled disposition of the anthers on a fleshy staminal column definitely indicates a relationship with *Hevea*. Nevertheless, the morphology of the column might be interpreted as rather intermediate between *Joannesia* and *Hevea*. We are able to point out a complete series, tending towards fusion of the filaments, from *Micrandra* (with free filaments) and *Joannesia* (with the filaments basally connate) through *Vaupesia* (with the filaments totally fused into a column which, however, shows by fluting the position of the individual filaments) to *Hevea* (with a perfectly terete column).

A comparison of the disks of both the pistillate and staminate flowers suggests, perhaps, a closer alliance with

Joannesia than with either *Hevea* or *Micrandra*. The structure of the stigmas, on the other hand, is definitely micrandroid.

Dr. Grady L. Webster, Research Fellow in Biology at Harvard University, has made a study of the pollen grains of *Vaupesia* and of related genera. His observations follow:

"The pollen-grains of *Vaupesia cataractarum* are characterized by a 'Croton-pattern' of ornamentation, as defined by Erdtman[4]. When expanded in lactic acid, they are spherical, about 72–77μ in diameter, and apparently non-aperturate. The ornamentation is due to a dense exinous layer of knob-like processes arranged, as illustrated by Erdtman for *Manihot* and *Jatropha* (op. cit., 170), in rings of five or six around a dim, circular area. The knobs in *Vaupesia* are about 4μ long and roundish or 3–5-angled in cross-section.

"Of the genera in the *Hevea*-complex, *Joannesia* shows the greatest similarity to *Vaupesia* in pollen morphology. The grains of *Joannesia princeps* are about the same size and have a very similar pattern of exinous knobs. In fact, one could not, on the basis of pollen morphology alone, distinguish the two genera. *Micrandra* and *Hevea*, on the other hand, have colporate grains and, palynologically, at least, stand further away."

Are we not justified in believing that *Vaupesia* represents, perhaps, a concept linking more closely the *Micrandra-Joannesia-Hevea* complex? And, likewise, may we not interpret *Vaupesia* as possibly a vestige of an ancient prototype of what we now see differentiated into *Micrandra, Joannesia* and *Hevea?*

Speciation in both *Hevea* and *Micrandra* has occurred to a much greater extent in the basin of the upper Río

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[4] Erdtman, G.: Pollen Morphology and Plant Taxonomy (1952) 173.

Negro and Vaupés than in any other area. Here are represented not only the greatest number of species of these two widespread groups, but endemism indicates that both *Hevea* and *Micrandra* may represent very ancient elements of the flora of this phytogeographically critical region.

The genus *Joannesia* is not represented, so far as we know, in this area. Its distribution is rather local: one species occurs in the coastal region of Brazil near Rio de Janeiro; a second is known from the Rio Tapajóz in the eastern Amazon.

The flora of the caatingas and caatinga-forests in the upper Río Negro-Vaupés basin shows very close affinities with that of the ancient Venezuela-Guiana land-mass. In fact, these caatingas (locally called "savanetas" in Colombia) are found in eastern Colombia either on the isolated quarzitic mountains of Cretaceous age (or on extensive sandy stretches associated with such mountains) or on granitic hills of the pre-Cambrian "Brazilian shield." The very numerous rapids in the rivers of the Colombian Comisaría del Vaupés are likewise associated with these quartzitic rocky outcrops or, along the Brazilian boundary, with granitic outcrops. *Vaupesia cataractarum* has been collected from caatinga-forests along both the quartzitic and the granitic cataracts: the type locality (the Falls of Jirijirimo on the Río Apaporis) and the base of Cerro Isibukuri, the western and southernmost stations known for the genus are quartzitic; the Falls of Tapira on the Río Vaupés and at Teresita on the Río Papurí are granitic. Both of these geological associations support peculiar and, presumably, ancient floras and seem to be repositories for endemic and apparently primitive species. We might enumerate many, but it will perhaps suffice to name several allies of the new genus: *Hevea rigidifolia* (Spruce ex Benth.) Muell.-Arg., *Micrandra*

Lopezii R. E. Schultes and *M. Sprucei* (Muell.-Arg.) R. E. Schultes, known only from the granitic caatinga-forests; *H. nitida* Mart. ex Muell.-Arg., *H. pauciflora* (Spruce ex Benth.) Muell.-Arg. var. *coriacea* Ducke and *Micrandra Rossiana* from both the granitic and quartzitic areas; and *H. nitida* var. *toxicodendroides* (Schult. & Vinson) R. E. Schultes, exclusively from the quartzitic mountains.

Vaupesia cataractarum occurs in caatinga-forests in close association with *Micrandra Spruceana* and *Hevea nitida.* Other tree-associates are *Monopteryx Uaucu* Spruce ex Benth. and *Couma catingae* Ducke. In the locality on the Río Papurí, it grows in stands which comprise almost exclusively *Vaupesia cataractarum* and *Micrandra Sprucei.*

The habitat of *Vaupesia cataractarum,* as the specific epithet implies, usually consists of hilly or sloping areas alongside or very near rapids. The ground is strewn with huge rocks, between which humus and sand has accumulated, creating a highly acid condition. In addition to the ample rainfall (more than 3 meters a year) which drenches the forests of this region, the sites chosen by *Vaupesia cataractarum* are almost perennially soggy as a result of the numerous rills and freshets that flow down from the higher hinterlands to empty into the river near the rapids.

The Desano Indians, speaking a Tukanoan dialect, refer to this tree as *ma-há-wa-soo* ("macaw-cunurí"), the same name which they apply to *Micrandra Rossiana* and *M. siphonioides* Benth. They know the superficially similar *cunurí* (*Micrandra Sprucei*) as *wa-soó.*

From late March through May, the large seeds of *Vaupesia cataractarum* fall in astonishingly large amounts. They are harvested from the ground by the Indians for food. Like the seeds of *Hevea* and *Micrandra,* they are extremely poisonous, until boiling breaks down the cyanic substances. They are also extremely rich in oil.

There is one important aspect of *Vaupesia cataractarum* which is still a puzzle. Sometimes a white, watery latex is present in the bark of the basal part of the trunk, but usually no trace of such a latex can be found. When present, it is a curiously resinous liquid drying to form a rather chalky white substance which easily crumbles in the hand. One tree (*Schultes & Cabrera 13339*) had a watery latex of a reddish color in the trunk, whereas nearly all of the more than eighty trees which I examined closely in the several localities possessed this reddish latex abundantly in the terminal branches, even when no evidence of it could be found elsewhere in the plant. Information from the Indians indicates that these anomalous conditions are not seasonal, and my own studies convince me that there is no relationship between the presence or absence of latex and its color and ecological factors. At first, I suspected that perhaps distinct varieties or forms might explain the problem, but there is no morphological evidence that we have at hand any taxonomic variants. In thus reluctantly leaving this interesting puzzle unsolved for the present, I must emphasize again the presence in *Joannesia heveoides* of a very similar thin, watery, red latex. *Joannesia*, of course, does not have the white latex common to all of its presumed allies, nor do these allies—*Hevea* and *Micrandra*—possess the red latex of *Joannesia* and *Vaupesia.*

The drawing of *Vaupesia cataractarum* and the distribution map published herewith were made possible through a grant from the United States Department of Agriculture with which I was associated when this new genus was discovered. I wish to express my appreciation to Dr. Julian A. Steyermark for his interest and advice in my treatment of this new concept.

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